REALM

Engineering

1767 Market Street, Suite C, Redding, CA 96001

HYDROLOGY REPORT

21258 MORGAN VALLEY ROAD, LOWER LAKE, CA

JUNE 29, 2020

Contents

Introduction

The purpose of this hydrology study is to assess the effect of a proposed development will have on existing stormwater runoff, and to provide design criteria to provide mitigation. This report was written to meet the requirements of Watershed Development Ordinance Article five "General Performance Standards" for Lake County.

Project Description

Site Description

The subject property consists of one parcel totaling approximately 80.1 acres of land. The purpose of this study is to evaluate the hydrological conditions and make recommendations for the proposed development in Lake County. Auto Canna, LLC ("Auto Canna") is seeking a Major Use Permit from the County of Lake for a proposed Outdoor Commercial Cannabis Cultivation Operation at 21258 Morgan Valley Road, Lower Lake, CA on Lake County APN 012-069-57 (Project Property). Auto Canna's proposed cultivation operation will be composed of four (4) A-Type 3 Medium Outdoor cultivation/canopy areas, with a total combined cultivation/canopy area of 153,560 ft2. Existing improvements on the Project Property include a groundwater well with a solar powered pump, a 5,000-gallon plastic water storage tank, a septic system designed for a single family dwelling, and a native soil surfaced access road. Proposed ancillary facilities include seven additional 5,000-gallon plastic water storage tanks, a gravel 20-foot wide access road, a 120 ft2 Pesticides and Agricultural Chemicals Storage Area (wooden shed), and a 5,000 ft2 Cannabis Drying & Storage Facility (metal building) with a roof-mounted photovoltaic solar array. Most of the parcel is covered in oak trees, native grasses and shrubs.

Topography at the subject site slopes from the approximate centerline of the property, running from East to West, Southwest and North. The approximate elevation range across the property is from 2852' to 2150' on the South side. Storm water runoff generally channel flows through natural Ephemeral Class III Watercourses across the property to the North and Southwest. Approximately 24 acres in the Southwest corner of the property has been designated a "No Development Zone." This zone slopes from 2600' to 2150' in a mean distance of 880'.

Proposed Land Use

The proposed use for this parcel is to construct 153,560 square feet of outdoor cultivation and a 5,000 square foot cannabis drying and storage facility. There will be several other small ancillary structures, see **Attachment A** for a preliminary site development plan/watershed area.

Proposed Stormwater Management System

The proposed stormwater runoff will convey surface flow similarly to the existing conditions. Stormwater will continue to flow to the Southwest and the North. The parcel will be divided into two watershed areas (North and South) to be analyzed separately. **Attachment A** illustrates these two watershed areas and the direction that stormwater flows. To prevent the increase of stormwater runoff for a 10, 25, or 100 year storm event, a stormwater detention basin will be provided.

The North half of the property has been labeled as Watershed A and is located within the Upper Cache Creek Watershed. This area contains all proposed impervious surfaces on the property. This area follows the natural topography of this portion of the site which slopes to the North. Runoff from these watercourses flows into Cache Creek. Watershed A will require one detention basin due to the small amount of impervious surface added (approximately 6620 square feet). **Attachment C** will show a detailed spreadsheet with the calculations for Watershed A.

The South half of the property has been labeled as Watershed B and is located within the Upper Putah Creek Watershed. The runoff in this area follows the natural topography of the site which slopes to the Southeast corner of the parcel. Runoff from these watercourses flows into Soda Creek. The proposed conditions for Watershed B add no new impervious surfaces due to the steep sloping topography, so stormwater runoff conditions will remain the same. There will be no need for an additional detention basin on the site. Runoff will continue to flow naturally.

Stormwater will be allowed to flow naturally as proposed development will not increase of storm water runoff for a 10, 25, and 100-year storm event. If needed, stormwater detention will be provided either in a pond, or in a subsurface stormwater detention system if site restrictions do not allow surface storage.

Hydrology Calculations

This hydrological analysis utilizes the Modified Rational method (Q = C * I * A) to calculate the peak stormwater runoff for 100-year storm events.

Where:
Q = Runoff (cfs)
C = Runoff Coefficient
I = Rainfall Intensity (inches per hour)
A = Area (acres)

Determination of Runoff Coefficient

The runoff coefficient "C" is based on the soil group and land use of the drainage basin (See **Attachment A**). This project lies in an area of soil group D, containing loams and clayey loams, as determined by referencing the soil survey maps (USDA Soil Survey). Soils in this area tend to retain moisture and will consequently have high runoff coefficients. Composite runoff coefficients were derived with the following formula:

$$C = \frac{(BC + DE)}{A}$$

Where:
A = Total Site Area (acres)
B = Impervious Site Area (acres)
C = Impervious Site Area Runoff Coefficient
D = Pervious Site Area (acres)
E = Pervious Site Area Runoff Coefficient

Watershed A

Surface	Area Pre Construction	Area Post Construction	C Value
Earth	29.439	29.287	0.4
Gravel	0.502	0.527	0.5
Roof	0.000	0.127	0.9
C-Weighted	0.402	0.404	-

Watershed B

Surface	Area Pre Construction	Area Post Construction	C Value
Earth	50.507	50.507	0.4
Gravel	0.154	0.154	0.5
Roof	0.000	0.000	0.9
C-Weighted	0.400	0.400	-

Determination of Intensity

Rainfall intensity (I) is typically found from Intensity/Duration/Frequency curves for rainfall events in the geographical region of interest. The Duration is usually equivalent to the time of concentration (Tc) of the drainage area. The Modified Rational Method was used to calculate stormwater runoff for a range of storm durations since the storm producing the maximum storage requirement does not necessarily correspond the Tc. Precipitation rates were derived from the NOAA Atlas 14 (See **Attachment B**). Peak discharge was computed at the time of concentration since this value yields the highest discharge for the existing conditions. Tc is the longest time required for a particle to travel from the watershed divide to the watershed outlet. For this study, the FAA (Federal Aviation Administration) equation was used.

FAA Equation: t = G (1.1 – c) L^0.5 / (100 S)^1/3

Where:

c = Rational Method runoff coefficient

G = Constant. FAA: G=1.8

L = Longest watercourse length in the watershed, ft.

S = Average slope of the watercourse, ft/ft.

t = Time of concentration, minutes.

Watershed A

Variables	Pre Construction	Post Construction
c	0.402	0.404
G	1.8	1.8
L	990	990
S	15%	15%
T	15.98	15.93

Watershed B

Variables	Pre & Post Construction
c	0.400
G	1.8
L	1781
S	40%
T	15.56

Watershed A

Variables	Pre Constuction	Post Construction
C	0.402	0.404
I	0.689	0.689
A	29.94	29.94
Q (Peak Flow)	8.29	8.33

Watershed B

Variables	Pre Constuction	Post Construction
C	0.400	0.400
I	0.689	0.689
A	50.66	50.66
Q (Peak Flow)	13.97	13.97

Detention Basin Sizing

Onsite stormwater detention basin will be constructed to detain runoff such that post-development discharge rates do not exceed the estimated pre-development discharge rates. The detention basin was sized using the Modified Rational Hydrograph Method (See **Attachment C**). The total volume of storage required is the area under the runoff hydrograph curve and above the basin outflow curve. The volume required for one (1) 100-year storm is 149 cf.

Modified Rational Method was also run for the 10- and 25-year storms per Lake County Watershed Development Ordinance. The results can be found in **Attachment C**.

The idea of using a detention basin is to be self-sustaining and convey no increase of storm water flow off the site. A back up system of a storm water catchment and leach system will be installed if necessary

Drainage Plan

All proposed storm water will run-off to the detention basin for Watershed A as to not increase the original storm water run-off. The detention basin will have the dimensions 8'L x 8'W x 2.5'H, which will allow for a storage capacity of 160 cubic feet. This storage capacity surpasses the 149 cubic feet needed, determined from the 100-year detention basin sizing calculation found in **Attachment C.** Stormwater runoff for Watershed B will be unaffected by the development. Runoff for this watershed will drain through the natural Ephemeral Class III Watercourses. **(See Attachment A)**

Control Boards Regulations

The project will comply with the California State Water Resources Control Board, the Central Valley Regional Water Quality Control Board, and/or the North Coast Regional Water Quality Control Board orders, regulations, and procedures through a formalized SWPPP. Since disturbance exceeds 1 acre a formal report will be written, and weekly monitoring will occur on-site during construction. In the event of qualifying forecasted precipitation, a Rain Event Action Plan will be prepared by the qualified SWPPP practitioner (QSP) and implemented through the contractor and legally responsible person. All weekly reports will be uploaded to the SMARTS website and annual reports will be filed by September 1st. Prior to a notice of termination all disturbed areas will be free of temporary erosion control measures and permanent BMP's will be installed and working.

Discharge of Irrigation or Stormwater from Each Premise

The illicit discharges of irrigation or storm water from the premises, as defined in Title 40 of the Code of Federal Regulations, section 122.26, which could result in degradation of water quality of any water body will be prevented though our catchment basin.

Lake County Maintained Drainage Systems

The Lake County maintained drainage or conveyance systems that the storm water is discharged into is located along Morgan Valley Road. In our professional opinion the storm water discharge follows the design parameters of the proposed structure with our proposed basin designed to handle 100-year flows. The proposed development site will be self-sustaining and not convey additional storm flows into the existing drainage easement. Monitoring of the system will be on going and a backup system of a storm water catchment and leach system will be installed if necessary where all flows are caught and sent to a leach pit 4' wide in diameter and 5' deep. The SWPPP will also require routine maintenance of the downstream existing infrastructure to keep trash and debris free from blockage.

Existing Bridges and Roads

There are no bridges downstream from the drainage system found on our site. Although, all best management practices will be in place and maintained to keep all debris, and on-site material from flowing off the site onto adjacent properties or roads.

Discharge Increasing the Volume of Water Off-Site

The discharge of storm water from the site will not increase the volume of water that historically has flowed onto adjacent properties. This will be accomplished through the installation of the detention basin that is sized to handle the pre vs. post run off for a design 10, 25, and 100-year storm. Monitoring of this basin will occur and if needed seepage pits will be installed to handle first flush of initial storm events.

Flood Elevations Downstream

The discharge of storm water will not increase flood elevations downstream of the discharge point. This will be accomplished through the installation of the detention basin that is sized to handle the pre vs. post run off for a design 10, 25, and 100-year storm. The site is not with in the FEMA flood zone or is the adjacent water course ordinary high-water mark affected by the proposed development.

Storm Water Management Ordinance

The project follows the requirements of Watershed Development Ordinance Article five for Lake County. The project complies because the proposed detention basin is designed to handle peak flows, and a leach field will be installed if needed to catch all storm water. These measures will ensure the County Ordinance Code will be followed and maintained.

Proposed Grading Methods

The proposed grading of the property will consist of a series of excavations for cut/fill pads to balance the site. There will be 3 pads constructed for the leveling and compaction of soil beneath the storage and processing building. The anticipation of grading activities will include a D5 cat dozer for initial rough grading, mid-sized excavator for trenching and the detention basin, skid steer and loader for the proposed road installation, sheep's foot roller for compaction, water truck to obtain optimum moisture of the soil and various hand tools for final grading. Protocol for grading activities will include a sequence of the following.

1. Construction staking for rough grading and scarification of the existing site
2. Rough grading using the D5 dozer and excavator.
3. Construction staking for final grades of pads and proposed roads and basin
4. Sheep's foot compactor and water truck to obtain compaction requirements
5. Final grading with the loader and skid steer.
6. Hand tools and bobcat to install erosion control and rock

BMP's During Construction

The best management practices (BMPs) that will be used during construction include the use of gravel bags to be stored on site, straw wattles (non-plastic), jute netting and crushed rock. The wattles will be installed per the erosion control plan by digging in along contour of the slopes near the toe and staking to ensure they are not ripped out due to the weather. Gravel bags will be placed within the proposed drainage swales to act as check dams and slow down the water to reduce scarification. Jute netting shall be placed upon all disturbed sloped to reduce rilling and erosion to compacted terraces. Crushed rock shall be installed in all construction travel ways to resist pumping and rutting of access points. All stockpiles shall be covered and weighted down to protect from forecasted rain and wind.

Post-construction BMP's will consist of hydro mulch and seeding of all disturbed areas with the design mix seeding as outlined within the SWPPP. Additionally, a construction entrance will be installed to ensure tracking off site to be reduced for all access points. Post-construction BMPs shall be maintained through the life of the permit with the installation of permanent erosion control measures and establishment of vegetation. The detention basin will include a rock outfall to protect against overtopping and erosion if overwhelmed from a large storm event. The basin and possible seepage pits will be the best defense against sediment migration off the site and will need to be cleaned out yearly to ensure it does not silt up

Monitoring of BMP's

The temporary BMP's will be monitored during construction through the SWPPP and enforced with weekly reports prepared by a qualified QSP provided to the contractor. The methodology of the monitoring program will be overseeing by the state SMARTS program and must obtain a WDID number for random inspections by the state. Post construction maintenance of the permanent erosion control measures will need to be in place after the notice of termination is granted. This maintenance will include the following.

1. Cleaning out of existing downstream structures prior to major rain events and after to ensure no blockage to inlets.
2. Removing silt and debris from the detention basin.
3. Placing drainage rock stockpiles on site to quickly deploy erosion to slopes and access roads
4. Installation of seepage pits to protect against first flush rain events
5. Upkeep of gravel check dams within proposed drainage pathways to slow down stormwater

Conclusion

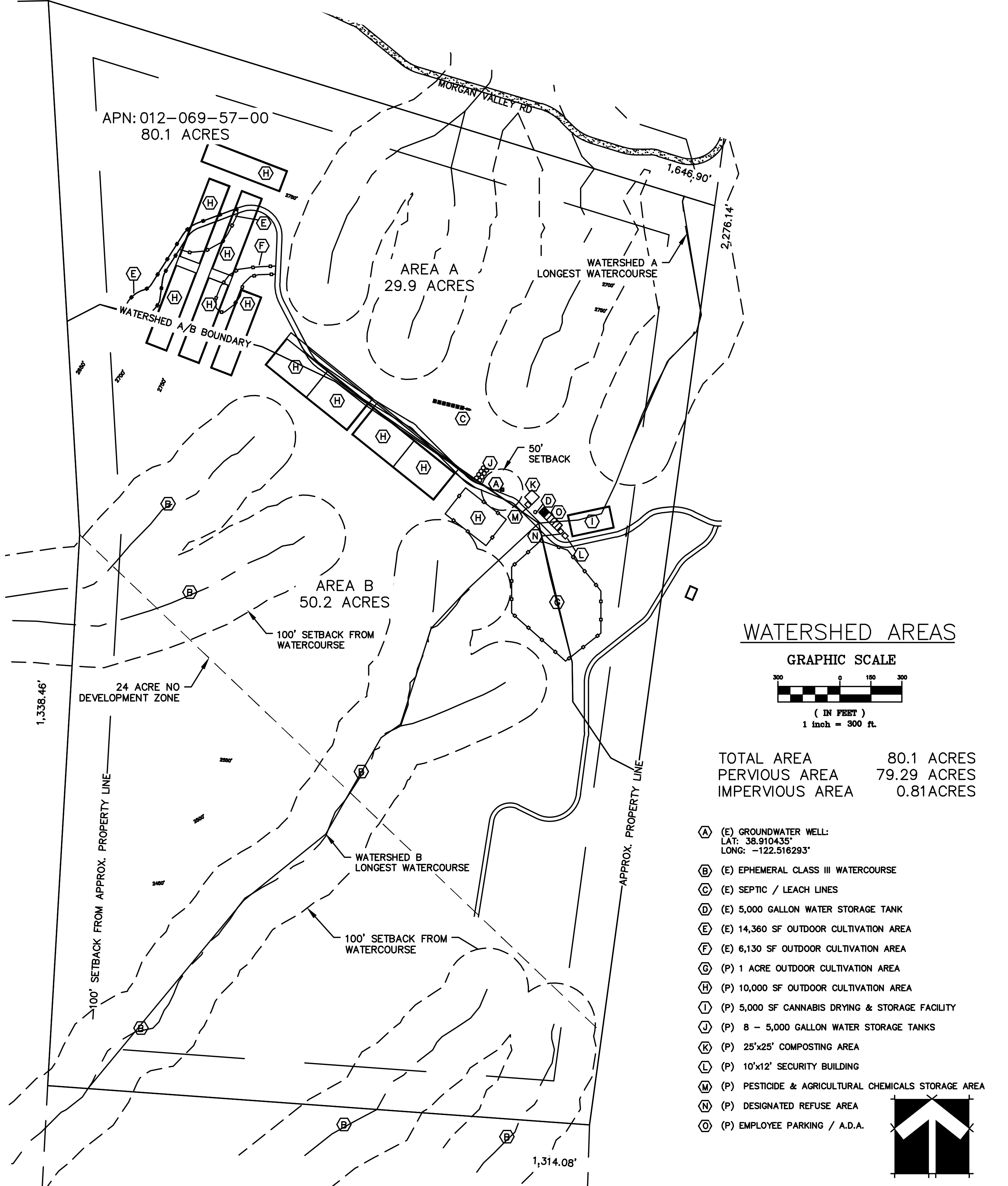
In conclusion, the contractor will install these retention measures, and it will be up to the property manager to maintain and expand upon if needed. We have provided evidence of minimum volumes that will need to be installed to help offset from flooding. Please feel free to contact me with any questions that you may have regarding this hydrological report.

Sincerely,
Jason Vine, P.E. 67800

Attachment A

AutoCanna, LLC

21258 MORGAN VALLEY ROAD
LOWER LAKE, CA 95457 - LAKE COUNTY
APN:012-069-57-00



Attachment B

United States Department of Agriculture

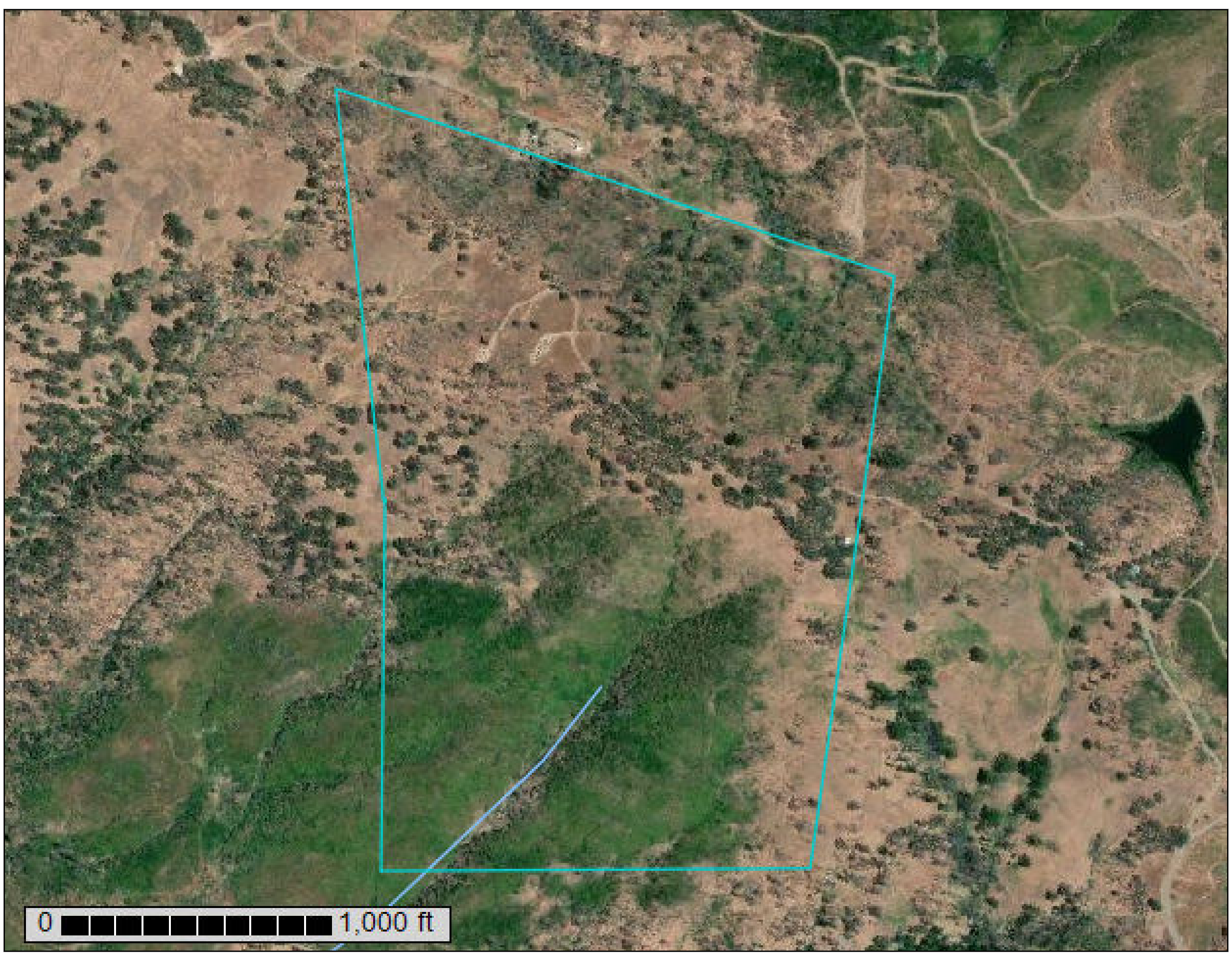
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Lake County, California



June 19, 2020

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

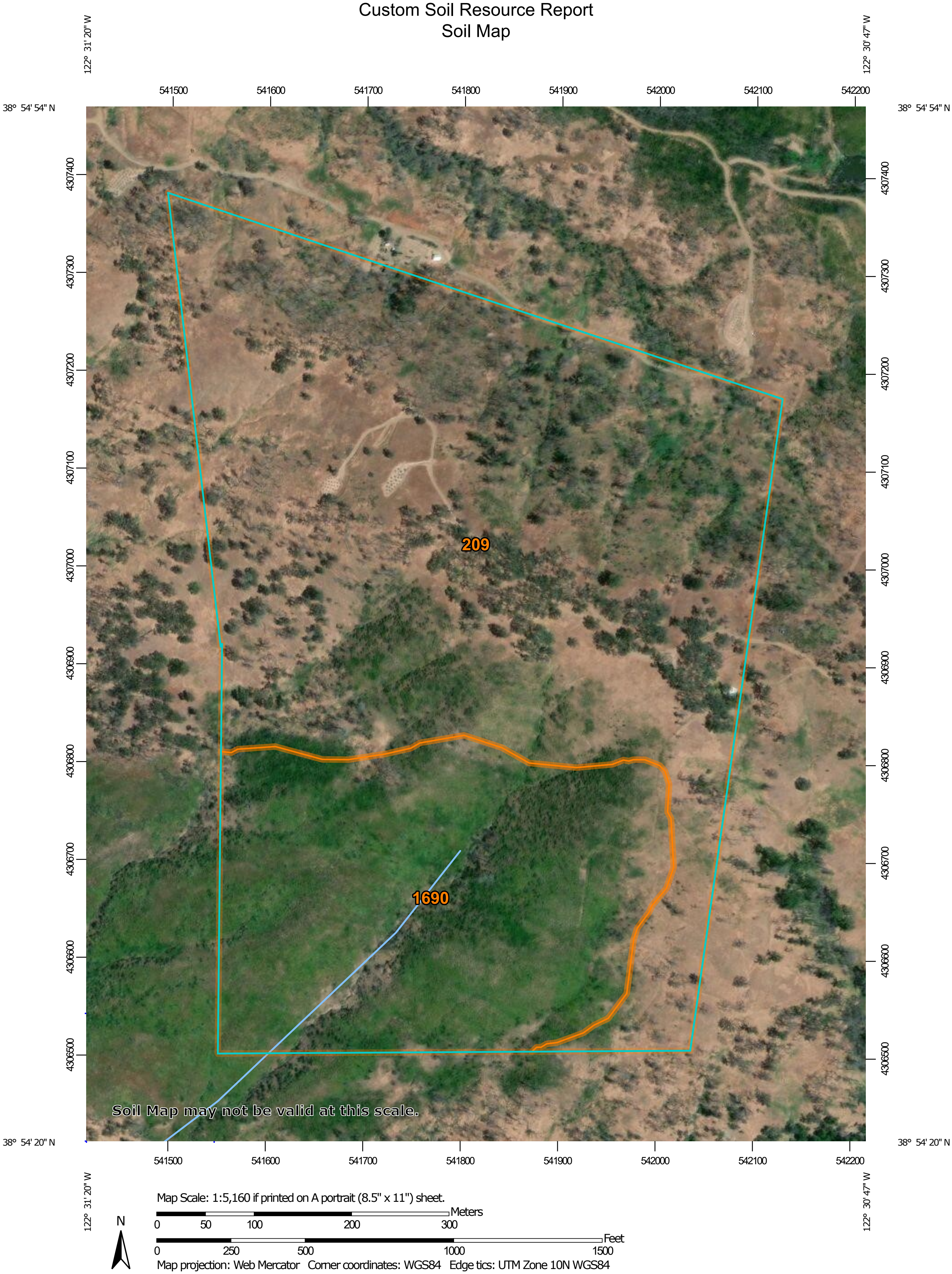
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map


122° 31' 20" W
122° 30' 47" W
38° 54' 54" N
38° 54' 20" N
541500
541600
541700
541800
541900
542000
542100
542200
4307400
4307300
4307200
4307100
4307000
4306900
4306800
4306700
4306600
4306500
209
1690
Soil Map may not be valid at this scale.
Map Scale: 1:5,160 if printed on A portrait (8.5" x 11") sheet.
Meters
0 50 100 200 300
Feet
0 250 500 1000 1500
N
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Lake County, California
Survey Area Data: Version 16, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 18, 2016—Nov 4, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
209	Skyhigh-Millsholm loams, 15 to 50 percent slopes	71.6	68.5%
1690	Maymen-Etsel-Snook complex, 30 to 75 percent slopes, low ffd	32.9	31.5%
Totals for Area of Interest		**104.5**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Lake County, California

209—Skyhigh-Millsholm loams, 15 to 50 percent slopes

Map Unit Setting

National map unit symbol: hf86
Elevation: 300 to 3,700 feet
Mean annual precipitation: 12 to 50 inches
Mean annual air temperature: 57 to 63 degrees F
Frost-free period: 130 to 330 days
Farmland classification: Not prime farmland

Map Unit Composition

Skyhigh and similar soils: 45 percent
Millsholm and similar soils: 25 percent
Minor components: 30 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Skyhigh

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, footslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Concave, convex
Parent material: Residuum weathered from sedimentary rock

Typical profile

H1 - 0 to 2 inches: loam
H2 - 2 to 8 inches: clay loam
H3 - 8 to 38 inches: clay
H4 - 38 to 48 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 50 percent
Depth to restrictive feature: 38 to 42 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: Steep Clayey Hills (R015XF006CA)
Hydric soil rating: No

Description of Millsholm

Setting

Landform: Hills
Landform position (two-dimensional): Backslope, shoulder, summit
Landform position (three-dimensional): Side slope
Down-slope shape: Convex, concave
Across-slope shape: Convex
Parent material: Residuum weathered from sedimentary rock

Typical profile

H1 - 0 to 6 inches: loam
H2 - 6 to 16 inches: clay loam
H3 - 16 to 26 inches: unweathered bedrock

Properties and qualities

Slope: 15 to 50 percent
Depth to restrictive feature: 16 to 20 inches to lithic bedrock
Natural drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 2.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Bressa

Percent of map unit: 10 percent
Hydric soil rating: No

Asbill

Percent of map unit: 4 percent
Hydric soil rating: No

Etsel

Percent of map unit: 4 percent
Hydric soil rating: No

Hopland

Percent of map unit: 3 percent
Hydric soil rating: No

Maymen

Percent of map unit: 3 percent
Hydric soil rating: No

Sleeper

Percent of map unit: 3 percent
Hydric soil rating: No

Unnamed

Percent of map unit: 3 percent
Hydric soil rating: No

1690—Maymen-Etsel-Snook complex, 30 to 75 percent slopes, low ffd

Map Unit Setting

National map unit symbol: 2y4jl
Elevation: 1,670 to 3,310 feet
Mean annual precipitation: 31 to 55 inches
Mean annual air temperature: 55 to 59 degrees F
Frost-free period: 196 to 275 days
Farmland classification: Not prime farmland

Map Unit Composition

Maymen and similar soils: 35 percent
Etsel and similar soils: 25 percent
Snook and similar soils: 20 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Maymen

Setting

Landform: Hillslopes, mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Convex, concave
Across-slope shape: Convex, concave
Parent material: Colluvium derived from sandstone and shale and/or residuum weathered from sandstone and shale

Typical profile

A - 0 to 4 inches: gravelly loam
Bw - 4 to 12 inches: gravelly loam
R - 12 to 22 inches: bedrock

Properties and qualities

Slope: 30 to 75 percent
Depth to restrictive feature: 10 to 20 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.2 to 0.5 mmhos/cm)
Available water storage in profile: Very low (about 1.7 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Etsel

Setting

Landform: Hillslopes, mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Convex, concave
Across-slope shape: Convex, concave
Parent material: Colluvium derived from sandstone and shale and/or residuum weathered from sandstone and shale

Typical profile

A1 - 0 to 3 inches: gravelly loam
A2 - 3 to 10 inches: very gravelly loam
R - 10 to 20 inches: bedrock

Properties and qualities

Slope: 30 to 75 percent
Depth to restrictive feature: 4 to 12 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Salinity, maximum in profile: Nonsaline (0.2 to 0.5 mmhos/cm)
Available water storage in profile: Very low (about 1.2 inches)

Interpretive groups

Land capability classification (irrigated): 7e
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Snook

Setting

Landform: Mountains, hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Concave, convex
Across-slope shape: Concave, convex
Parent material: Colluvium derived from sandstone and shale and/or residuum weathered from sandstone and shale

Typical profile

A - 0 to 5 inches: loam
R - 5 to 15 inches: bedrock

Properties and qualities

Slope: 30 to 75 percent

Depth to restrictive feature: 5 to 9 inches to lithic bedrock
Natural drainage class: Somewhat excessively drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Very low (about 0.9 inches)

Interpretive groups

Land capability classification (irrigated): 8
Land capability classification (nonirrigated): 8
Hydrologic Soil Group: D
Hydric soil rating: No

Minor Components

Mayacama

Percent of map unit: 7 percent
Landform: Hillslopes, mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Concave, convex
Across-slope shape: Concave, convex
Hydric soil rating: No

Hopland

Percent of map unit: 7 percent
Landform: Hillslopes, mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, side slope
Down-slope shape: Concave, convex
Across-slope shape: Concave, convex
Hydric soil rating: No

Rock outcrop

Percent of map unit: 6 percent
Landform: Mountains
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

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Attachment C

NOAA Atlas 14, Volume 6, Version 2
Location name: Lower Lake, California, USA*
Latitude: 38.9194°, Longitude: -122.5051°
Elevation: 3127.65 ft**

* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.116** (0.103-0.132)	**0.150** (0.133-0.171)	**0.198** (0.175-0.226)	**0.239** (0.210-0.275)	**0.298** (0.251-0.356)	**0.346** (0.285-0.424)	**0.397** (0.319-0.500)	**0.453** (0.352-0.589)	**0.625** (0.464-0.851)	**0.920** (0.657-1.30)
10-min	**0.166** (0.148-0.189)	**0.216** (0.191-0.245)	**0.284** (0.251-0.324)	**0.343** (0.300-0.395)	**0.427** (0.360-0.511)	**0.496** (0.409-0.608)	**0.569** (0.457-0.717)	**0.650** (0.505-0.844)	**0.896** (0.665-1.22)	**1.32** (0.942-1.87)
15-min	**0.201** (0.179-0.228)	**0.261** (0.231-0.297)	**0.343** (0.304-0.392)	**0.414** (0.363-0.477)	**0.516** (0.436-0.618)	**0.600** (0.494-0.735)	**0.689** (0.552-0.867)	**0.786** (0.610-1.02)	**1.08** (0.804-1.48)	**1.60** (1.14-2.26)
30-min	**0.281** (0.250-0.320)	**0.365** (0.324-0.415)	**0.481** (0.425-0.548)	**0.580** (0.509-0.668)	**0.723** (0.610-0.865)	**0.840** (0.692-1.03)	**0.964** (0.773-1.21)	**1.10** (0.855-1.43)	**1.52** (1.13-2.07)	**2.23** (1.59-3.16)
60-min	**0.399** (0.355-0.454)	**0.518** (0.460-0.590)	**0.682** (0.604-0.779)	**0.824** (0.722-0.949)	**1.03** (0.866-1.23)	**1.19** (0.983-1.46)	**1.37** (1.10-1.72)	**1.56** (1.21-2.03)	**2.15** (1.60-2.93)	**3.17** (2.26-4.49)
2-hr	**0.629** (0.559-0.715)	**0.806** (0.716-0.917)	**1.04** (0.918-1.18)	**1.23** (1.08-1.41)	**1.48** (1.25-1.78)	**1.68** (1.39-2.06)	**1.88** (1.51-2.37)	**2.09** (1.63-2.72)	**2.38** (1.76-3.24)	**3.20** (2.29-4.53)
3-hr	**0.835** (0.742-0.949)	**1.06** (0.941-1.21)	**1.35** (1.20-1.54)	**1.58** (1.39-1.82)	**1.89** (1.60-2.26)	**2.13** (1.75-2.61)	**2.36** (1.89-2.97)	**2.60** (2.02-3.38)	**2.92** (2.17-3.98)	**3.24** (2.31-4.58)
6-hr	**1.28** (1.14-1.46)	**1.61** (1.43-1.83)	**2.03** (1.79-2.31)	**2.35** (2.06-2.71)	**2.78** (2.35-3.33)	**3.10** (2.55-3.79)	**3.41** (2.73-4.29)	**3.72** (2.89-4.84)	**4.13** (3.06-5.63)	**4.44** (3.17-6.29)
12-hr	**1.90** (1.69-2.16)	**2.38** (2.12-2.71)	**3.00** (2.65-3.42)	**3.49** (3.06-4.01)	**4.13** (3.49-4.94)	**4.61** (3.80-5.65)	**5.09** (4.08-6.41)	**5.57** (4.33-7.24)	**6.21** (4.60-8.45)	**6.69** (4.78-9.47)
24-hr	**2.81** (2.52-3.19)	**3.53** (3.17-4.01)	**4.47** (4.00-5.10)	**5.24** (4.66-6.01)	**6.27** (5.42-7.39)	**7.05** (6.00-8.46)	**7.85** (6.55-9.61)	**8.67** (7.07-10.9)	**9.78** (7.70-12.7)	**10.6** (8.13-14.2)
2-day	**3.67** (3.29-4.16)	**4.61** (4.13-5.24)	**5.85** (5.24-6.67)	**6.87** (6.12-7.89)	**8.28** (7.17-9.77)	**9.38** (7.98-11.3)	**10.5** (8.77-12.9)	**11.7** (9.52-14.6)	**13.3** (10.5-17.3)	**14.6** (11.2-19.5)
3-day	**4.23** (3.80-4.81)	**5.32** (4.77-6.05)	**6.76** (6.05-7.70)	**7.96** (7.08-9.13)	**9.61** (8.32-11.3)	**10.9** (9.28-13.1)	**12.3** (10.2-15.0)	**13.7** (11.1-17.1)	**15.6** (12.3-20.2)	**17.2** (13.1-22.9)
4-day	**4.68** (4.21-5.32)	**5.89** (5.28-6.70)	**7.49** (6.70-8.53)	**8.81** (7.83-10.1)	**10.6** (9.20-12.5)	**12.1** (10.3-14.5)	**13.5** (11.3-16.6)	**15.1** (12.3-18.9)	**17.2** (13.5-22.3)	**18.9** (14.4-25.2)
7-day	**5.79** (5.20-6.57)	**7.29** (6.54-8.29)	**9.24** (8.27-10.5)	**10.8** (9.62-12.4)	**13.0** (11.2-15.3)	**14.6** (12.4-17.5)	**16.3** (13.6-19.9)	**18.0** (14.6-22.5)	**20.3** (16.0-26.3)	**22.1** (16.9-29.5)
10-day	**6.57** (5.90-7.46)	**8.29** (7.44-9.43)	**10.5** (9.39-12.0)	**12.2** (10.9-14.1)	**14.6** (12.6-17.2)	**16.4** (13.9-19.6)	**18.1** (15.1-22.2)	**19.9** (16.2-25.0)	**22.4** (17.6-29.0)	**24.2** (18.5-32.3)
20-day	**8.65** (7.77-9.83)	**11.0** (9.85-12.5)	**13.9** (12.4-15.8)	**16.1** (14.4-18.5)	**19.1** (16.5-22.5)	**21.2** (18.0-25.4)	**23.3** (19.4-28.5)	**25.4** (20.7-31.8)	**28.1** (22.1-36.5)	**30.2** (23.0-40.3)
30-day	**10.4** (9.38-11.9)	**13.3** (11.9-15.1)	**16.8** (15.0-19.1)	**19.4** (17.3-22.3)	**22.8** (19.8-26.9)	**25.3** (21.5-30.3)	**27.7** (23.1-33.8)	**30.0** (24.4-37.6)	**33.0** (25.9-42.7)	**35.2** (26.9-46.9)
45-day	**12.9** (11.6-14.7)	**16.4** (14.7-18.7)	**20.6** (18.5-23.5)	**23.8** (21.2-27.3)	**27.8** (24.1-32.8)	**30.6** (26.1-36.8)	**33.3** (27.8-40.8)	**35.9** (29.3-45.0)	**39.2** (30.9-50.9)	**41.6** (31.8-55.6)
60-day	**15.2** (13.6-17.2)	**19.2** (17.2-21.8)	**24.0** (21.5-27.4)	**27.6** (24.6-31.7)	**32.1** (27.8-37.8)	**35.2** (29.9-42.2)	**38.1** (31.8-46.7)	**40.9** (33.3-51.3)	**44.5** (35.0-57.7)	**47.0** (35.9-62.7)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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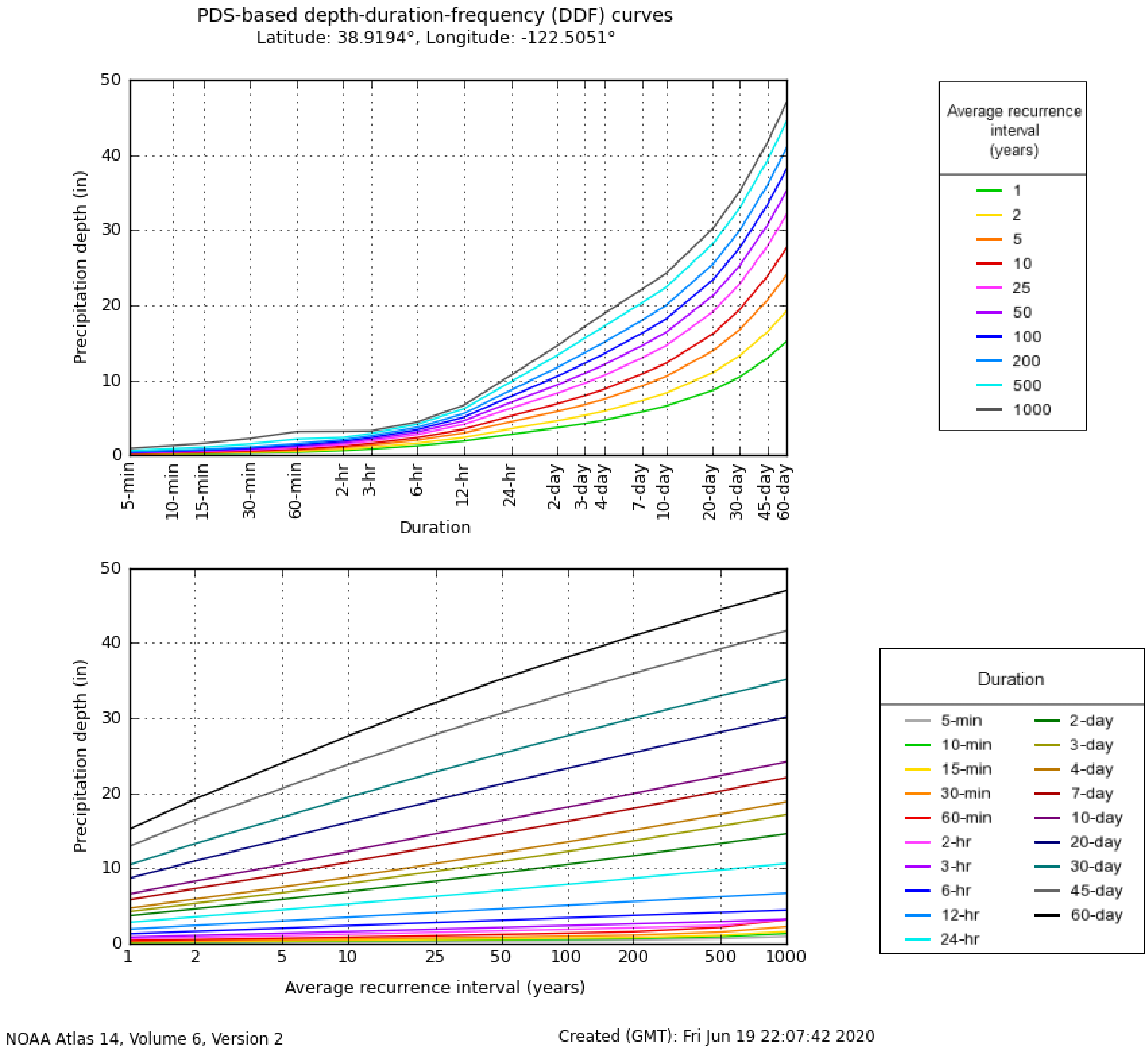
PF graphical



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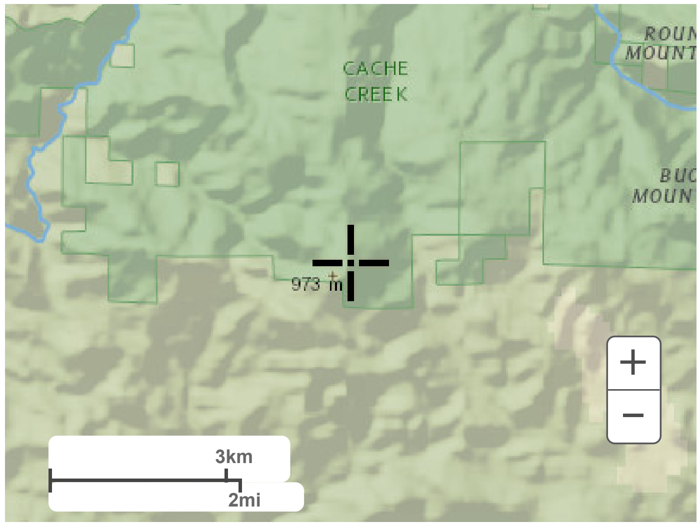
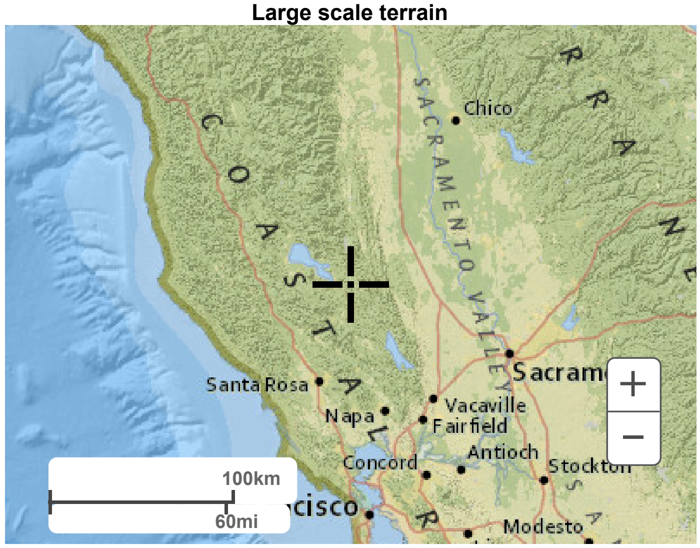
Maps & aerials

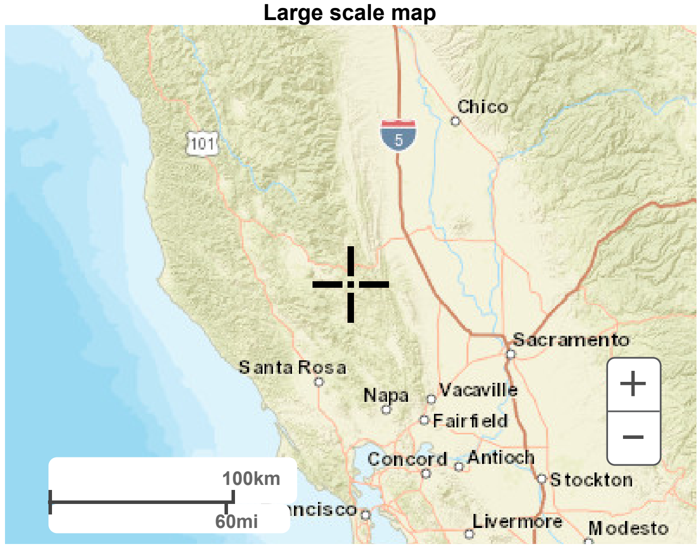
Small scale terrain



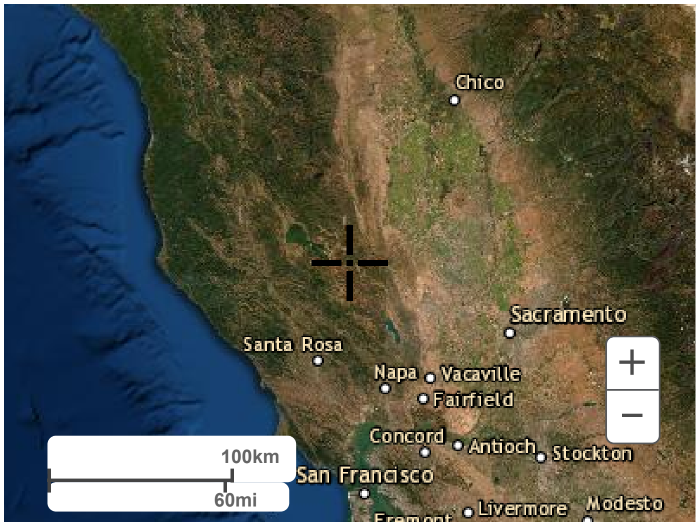
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Attachment D

Modified Rational Method Detention Basin Sizing Tool						
Location:	Lake County			**Area (ac)**	29.94	
Project:	100-Year			**Cexist**	0.402	
Job No.:	AutoCanna LLC			**Cproj**	0.404	
Date:	6/24/2020			**Tc (min)***	15	
By:	Jason Vine			**i for Tc**	2.756	
Chk By:	A. Flynn			**Qexist (cfs)**	33.2	

Storm Duration (Min)	**100 Yr Precip (in)**	**Intensity (i=in/hr)**	**Peak Runoff (cfs)**	**Project Runoff Volume (cf)**	**Allowable Q Runoff Volume**	**Required Storage (cf)**
5	0.4	4.2	50.8	254.0	331.7	-4661.9
10	0.6	3.4	41.3	412.9	414.6	-101.2
15	0.7	2.8	33.3	500.0	497.6	148.5
20	0.8	2.3	28.3	566.8	580.5	-821.0
30	1.0	1.9	23.3	699.6	746.3	-2803.6
60	1.4	1.4	16.6	994.3	1243.9	-14978.2
120	1.9	0.9	11.4	1364.4	2239.0	-52478.0
180	2.4	0.8	9.5	1712.8	3234.2	-91284.1
360	3.4	0.6	6.9	2474.8	6219.5	-224684.9
720	5.1	0.4	5.1	3694.0	12190.3	-509775.3
1440	7.9	0.3	4.0	5697.1	24131.8	-1106083.0

Required Storage Volume (cf)	**149**
Required Storage Volume (acft)	**0.00**

*Round Tc to closest Storm Duration

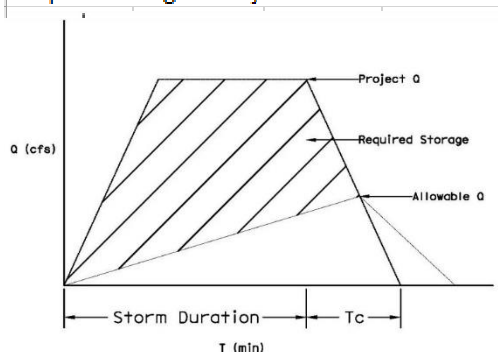
Q=CiA

100-Yr Precip - From NOAA Atlas 14 (attach Point Precipitation Frequency Estimate)

Project Runoff Volume = Qproj * Storm Duration

Allowable Q Runoff Volume = (Qexist * (Storm Duration + Tc))/2

Required Strage = Project Runoff Volume - Allowable Q Runoff Volume



Modified Rational Method
Detention Basin Sizing Tool

Location:	Lake County	**Area (ac)**	29.94
Project:	25-Year	**Cexist**	0.402
Job No.:	AutoCanna LLC	**Cproj**	0.404
Date:	6/24/2020	**Tc (min)***	15
By:	Jason Vine	**i for Tc**	2.1
Chk By:	A. Flynn	**Qexist (cfs)**	24.8

Storm Duration (Min)	100 Yr Precip (in)	Intensity (i=in/hr)	Peak Runoff (cfs)	Project Runoff Volume (cf)	Allowable Q Runoff Volume (cf)	Required Storage (cf)
5	0.3	3.6	43.3	216.3	248.4	-1928.9
10	0.4	2.6	31.0	309.9	310.5	-37.9
15	0.5	2.1	25.0	374.5	372.6	111.2
20	0.6	1.8	21.2	424.6	434.7	-610.5
30	0.7	1.4	17.5	524.7	558.9	-2053.9
60	1.0	1.0	12.5	747.5	931.6	-11043.5
120	1.5	0.7	9.0	1074.1	1676.8	-36164.1
180	1.9	0.6	7.6	1371.7	2422.1	-63026.5
360	2.8	0.5	5.6	2017.6	4657.9	-158418.8
720	4.1	0.3	4.2	2997.3	9129.5	-367927.6
1440	6.3	0.3	3.2	4550.4	18072.6	-811330.3

Required Storage Volume (cf)	**111**
Required Storage Volume (acft	**0.00**

*Round Tc to closest Storm Duration

Q=CiA

100-Yr Precip - From NOAA Atlas 14 (attach Point Precipitation Frequency Estimate)

Project Runoff Volume = Qproj * Storm Duration

Allowable Q Runoff Volume = (Qexist * (Storm Duration + Tc))/2

Required Strage = Project Runoff Volume - Allowable Q Runoff Volume

Modified Rational Method
Detention Basin Sizing Tool

Location:	Tehama County	**Area (ac)**	29.94
Project:	10-Year	**Cexist**	0.402
Job No.:	AutoCanna LLC	**Cproj**	0.404
Date:	6/24/2020	**Tc (min)***	15
By:	Jason Vine	**i for Tc**	1.8
Chk By:	A. Flynn	**Qexist (cfs)**	21.8

Storm Duration (Min)	100 Yr Precip (in)	Intensity (i=in/hr)	Peak Runoff (cfs)	Project Runoff Volume (cf)	Allowable Q Runoff Volume (cf)	Required Storage (cf)
5	0.2	3.1	37.9	189.3	217.8	-1713.0
10	0.3	2.3	27.2	272.2	272.3	-9.4
15	0.4	1.8	21.9	328.4	326.8	97.5
20	0.5	1.6	19.6	391.9	381.2	640.0
30	0.6	1.2	14.9	446.3	490.2	-2629.7
60	0.8	0.9	10.4	623.4	816.9	-11611.2
120	1.2	0.6	6.7	807.0	1470.5	-39807.3
180	1.6	0.4	5.2	940.6	2124.0	-71007.9
360	2.4	0.3	3.5	1258.4	4084.7	-169574.0
720	3.5	0.2	2.4	1724.4	8006.0	-376895.7
1440	5.2	0.1	1.7	2473.3	15848.5	-802512.3

Required Storage Volume (cf)	**640.0**
Required Storage Volume (acft)	**0.01**

*Round Tc to closest Storm Duration

Q=CiA

100-Yr Precip - From NOAA Atlas 14 (attach Point Precipitation Frequency Estimate)

Project Runoff Volume = Qproj * Storm Duration

Allowable Q Runoff Volume = (Qexist * (Storm Duration + Tc))/2

Required Strage = Project Runoff Volume - Allowable Q Runoff Volume